

F-35 AFFORDABILITY MEASURES AND IMPLICATIONS

Kong Hshanglan, Zhang Jurong, Jiang Yong

Air Force Engineering University, Xi'an, China

Abstract: *This paper analyses the three affordability measures of F-35: facilitating affordable operational requirements with an unprecedented scope, emphasizing cost as an independent variable and a robust set of models and simulations; emphasizing acquisition reform initiatives that include cancelling MIL-STDs and MILSPECS, featuring performance-based specifications, developing the model spec; Promoting high commonality. The long term affordability challenges are also mentioned. Finally, implications are analyzed.*

Keywords: *F-35; affordability measures; affordable operational requirements; acquisition reform initiatives; high commonality*

1. INTRODUCTION

“The F-35 Lightning II, the Joint Strike Fighter, is DOD’s most costly and ambitious aircraft acquisition.

The program is developing and fielding three aircraft variants for the Air Force, Navy, Marine Corps, and eight international partners.

The F-35 is critical to long-term recapitalization plans as it is intended to replace hundreds of existing aircraft.

This will require a long-term sustained funding commitment.

Going forward, ensuring affordability—the ability to acquire aircraft in quantity and to sustain them over the life cycle—is of paramount concern” [1].

The focus of the JSF program is affordability — reducing the development cost, production cost, and cost of ownership.

“The JSF Vision is to be the model program for joint service and international cooperation and develop and produce an affordable next generation strike fighter weapon system and sustain it worldwide” [2].

Affordability is the number one consideration of the program.

This paper highlights its measures and implications.

2. F-35 AFFORDABILITY MEASURES

“... Annual acquisition funding requirements for the United States currently average \$12.6 billion per year through 2037” [1]. The F-35 JSF Program is accomplishing affordability by taking such measures as facilitating operational requirements, emphasizing the acquisition reform initiatives, and promoting high commonality.

2.1 Facilitating Affordable Operational Requirements. The F-35 program is accomplishing affordability by facilitating the Services’ development of validated, affordable operational requirements.

2.1.1 Starting with an unprecedented scope. The program’s joint operational requirements development started with an unprecedented scope. Since the beginning in 1994, “The process has involved the full-time participation of “warfighter” representatives, experienced pilots, logisticians, and maintenance officers assigned by each service to support the JSF program.

No similar requirements document has ever been produced by warfighters with such a plethora of information on which to base decisions on requirements” [3].

2.1.2 Emphasizing cost as an independent variable (CAIV). The emphasis is on cost as an independent variable (CAIV), “CAIV has enabled the programs and contractors to set and maintain cost objectives” [4].

This analysis significantly reduces conceptual and preliminary design time, which in turn reduces overall program cycle time.

This reduction in program cycle time leads to reductions in overall cost and time to market [5].

The emphasis is on balancing costs with operational performance requirements.

The goal is to do trade-offs to ensure that the requirements the Services are asking for will meet their needs, and make sure that the aircraft will come in at a cost that the Services’ budgets can afford.

2.1.3 Models and Simulations. The services have a robust set of models and simulations with which they can look at generic performance levels for a JSF, coupled with associated cost estimates provided by industry and the program office.

2.2 Emphasizing Acquisition Reform Initiatives. The F-35 JSF Program is taken as the Flagship Acquisition Reform Program.

It is the first major aviation acquisition effort that emphasizes the acquisition reform initiatives first mandated by William Perry in 1994 as Secretary of Defense [3].

The objective of these initiatives is to break the accelerating upward spiral of the cost of military aircraft programs by streamlining the DoD’s acquisition process.

2.2.1 Cancelling thousands of DoD MIL-STDs and MILSPECS. One of the major features of these initiatives is the cancellation of thousands of DoD military standards and specifications (MIL-STDs and MILSPECS).

These documents overspecified requirements, mandated “design-to” details, and limited the contractors’ flexibility in providing an optimized product.

2.2.2 Performance-based specifications. Another key feature of the reformed process is performance-based specifications (PBS) which have the following attributes [3]:

(1) specifying Functional Performance/ Results

(2) defining the Environment in Which System Must Operate

(3) defining the System Interfaces

(4) defining the Operating and Support Characteristics

(5) utilizing Measurable and Verifiable Requirements

The above attributes show that in the PBS, the government states a need for a capability by specifying functional performance, the environment in which the system must operate, the interfaces to existing or planned systems, and the expected operating and support characteristics.

For example, instead of specifying that the JSF has a radar and requiring specific design features such as power output, pulse repetition frequency, scan rate, etc., the government would specify a need to detect, track, and identify targets at tactically significant ranges.

The contractor may or may not decide to use a radar to satisfy this need; there may be some other onboard (or outboard) sensor that may perform better and be more affordable.

The point is that the contractor has the flexibility to use best design practices and leverage available technology in order to meet the need.

2.2.3 Developing the model spec. To operate in this new PBS environment, the Joint Program Office (JPO) established a PBS working group in December 1996 to develop the JSF model specification.

This group is made up of representatives from JPO, Boeing, and Lockheed-Martin who have strong systems engineering backgrounds, especially in requirements development.

The model spec. includes the following attributes:

(1) defining system performance that meets the requirements defined in the Joint Interim Requirements Document/Joint Operational Requirements Document (JIRD/ JORD);

(2) defining the minimum essential requirements necessary on contract for the government to manage the program;

- (3) specifying the request for proposal (RFP) and tailored in the contractors' EMD proposals;
- (4) being developed in a timely manner to support JSF scheduled events; and
- (5) allowing the government and contractor to minimize surprises in the "downselect" process.

All the above attributes of the model spec is intended to concentrate on the key or critical performance requirements that would make or break the program, and would include only the performance minimums contained in the JIRD/ JORD. The JIRD/ JORD will also include desired "objectives" which the contractors may decide to design in order to have a competitive advantage. What all this means is that the JSF model spec, which will form the basis of the contract spec, will contain, as a goal, 150 to 200 requirements. Contrast this number with the more than 16,000 contractual requirements on the F/A-18E/F and more than 6,000 on the F-22 [3].

As shown in Figure 1, the function of the model spec will be "contractor generic" — that is, the same for each competitor and its development is paid for by the government during the concept demonstration phase.

Each contractor will develop a "JSF contract specification" specific to its design, which will capture all of the model specifications.

2.2.4 Restructuring actions.

"In February 2010, the Department announced a major restructuring of the JSF program, including reduced procurement and a planned move to fixed-price contracts, because of additional costs and schedule delays.

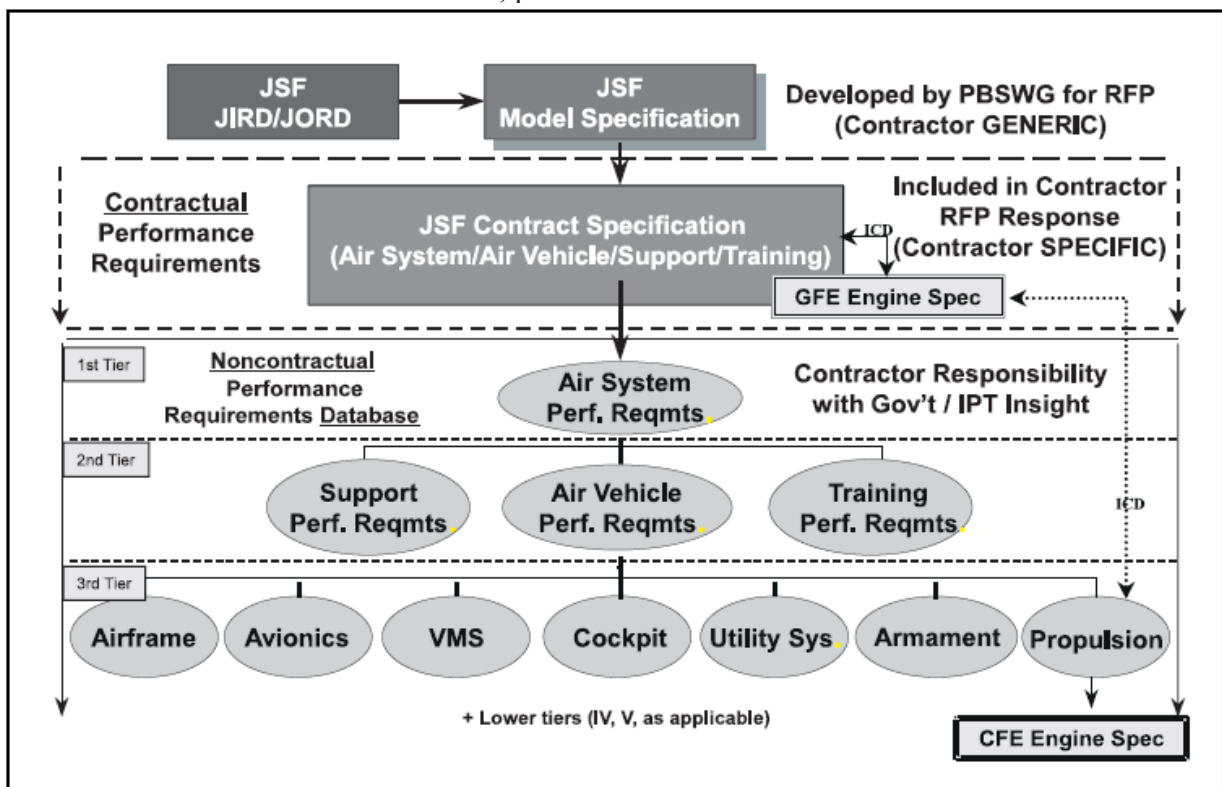
The Secretary of Defense placed the STOVL variant on a 2-year probation; decoupled STOVL from the other variants in the testing program because of lingering technical issues; and reduced STOVL production plans for fiscal years 2011 to 2013" [6].

Extensive restructuring actions have placed the JSF program on a more achievable course.

At the same time, the near-constant churn, or change, in cost, schedule, and performance expectations has hampered oversight and insight into the program, in particular the ability to firmly assess progress and prospects for future success.

"The Department's restructuring actions have helped reduce near-term risks by lowering annual procurement quantities and allowing more time and resources for flight testing.

Figure 1
A Performance-Based Specification Tree
Source: Robert G. Struth, Jr. Systems engineering, and the joint strike fighter: the flagship program for acquisition reform, Acquisition Review Quarterly—Summer 2000, p.227



Procurement funding reflects the reduction of 179 aircraft in annual procurement quantities from fiscal year 2013 to fiscal year 2017” [6].

2.3 Promoting high commonality. Another approach to affordability is that the F-35 JSF program has high commonality.

That is, the program has to meet the needs of three Services: Air Force, Navy, and Marine Corps; full partners and eight international partners and dozens of other countries buying the system and/or building major subsystems of the program with three aircraft variants based around a core of airframe, avionics, and propulsion technologies.

“The JSF family of aircraft will be designed with affordability as the cornerstone of the program with strong emphasis on a balanced “best value” approach among its operational capabilities and attributes.

The JSF will be capable of striking and destroying a broad range of targets, day or night, in adverse weather conditions.

These targets include: fixed and mobile land targets, enemy surface units at sea, and air threats ashore and at sea including anti-ship and land attack cruise missiles. The characteristics of each Service’s aircraft will be very similar; however they will be Service specific to meet their unique operating requirements” [7].

From the above process we can see that the acquisition reform initiatives will only be optimized when the prime contractors promote a relationship with their teammates and subcontractors that focus on performance-based specifications and the other aspects of acquisition reform.

3. LONG TERM AFFORDABILITY CHALLENGES

According to United States Government Accountability Office (GAO), GAO-12-437, the DOD restructuring actions only reduces near term risk, but long term affordability is challenging.

Full rate production is now planned for 2019, a delay of 6 years from the 2007 baseline.

Unit cost estimates continue to increase and have now doubled since the start of development.

“In March 2012, DOD established a new acquisition program baseline for the F-35 program that incorporated the numerous positive and more realistic restructuring actions taken since 2010.

The new JSF baseline projects a total acquisition cost of \$395.7 billion, an increase of \$117.2 billion (42 percent) from the prior 2007 baseline.” [6].

4. IMPLICATIONS

The study of the F-35 Lightning II Program throws some light on our military aircraft acquisition.

First, ensuring that the acquisition costs are affordable so that aircraft can be bought in the quantities and time required by the warfighter.

Second, accomplishing affordability by facilitating the Services’ development of validated, affordable operational requirements is of vital importance.

Finally, developing a robust set of models and simulations and emphasizing acquisition reforms can also play a key role. The government states the need for a capability by specifying functional performance, the environment, the interfaces to existing or planned systems, and the expected operating and support characteristics, concentrating on the key or critical performance requirements. Each contractor will develop a contract specification specific to its design.

REFERENCES

1. United States Government Accountability Office (GAO), GAO-13-309, *JOINT STRIKE FIGHTER, Current Outlook Is Improved, but Long-Term Affordability Is a Major Concern*, March 2013
2. Luke Gill, *F-35 Joint Strike Fighter Autonomic Logistics Supply Chain*, Lockheed Martin, October 23, 2003
3. Robert G. Struth, Jr. *SYSTEMS ENGINEERING, AND THE JOINT STRIKE FIGHTER: THE FLAGSHIP PROGRAM FOR ACQUISITION REFORM*, Acquisition Review Quarterly—Summer 2000
4. Kevin W. Codrington, *COST AS AN INDEPENDENT VARIABLE: A STUDY OF ITS CONTINUED USE*, Graduate School of Engineering and Management, Air Force Institute of Technology, Air University, Air Education and Training Command, March
5. Lt. Corey Bliss, *Interactive Missile Design Program Accelerates Spiral Development*, AF ManTech Highlights, Spring 2003
6. United States Government Accountability Office (GAO), GAO-12-437, *JOINT STRIKE FIGHTER DOD Actions Needed to Further Enhance Restructuring and Address Affordability Risks*, June 2012
7. *JOINT STRIKE FIGHTER SYSTEM TRAINING PLAN, DRAFT JSF STP DATED 1 OCTOBER, 2001*